Safety Culture

A model for understanding & quantifying a difficult concept

By Dominic Cooper

INDUSTRIES WORLDWIDE ARE SHOWING increased interest in the concept of "safety culture" as a means of reducing the potential for large-scale disasters, as well as the inherent risks associated with routine tasks. The extent of this interest was illustrated by the "Corporate Culture and Transportation Safety" symposium sponsored by the National Transportation Safety Board in 1997; it drew 550 attendees from associated industries. Publicized efforts to achieve homogeneous worldwide safety cultures in the offshore (May 127+) nuclear (Rosen 287+) and shipping (Payer 12+) industries also testify to its growing importance. Although well-intentioned, such aims also illustrate the confusion that surrounds the concept within the safety profession and academia. In both areas, this confusion centers on what a safety culture is—and how it can be achieved.

The Concept of Corporate Culture

Since recognizing that its structure has limitations in providing the "glue" that holds organizations together, much management thinking over the last two decades has focused on the concept of corporate culture. Usually based on a blend of visionary ideas, the dominating culture within any organization is supported by ongoing analyses of organizational systems, goal-directed behavior, attitudes and performance outcomes (Fry and Killing 64+). Although no universal definition of corporate culture exists, it appears to reflect shared behaviors, beliefs, attitudes and values regarding organizational goals, functions and procedures (Furnham and Gunter). The main difference among available definitions involves their focus on the way people think or on the way people behave (Williams, et al), although some focus on both aspects (Uttal).

The idea that corporate cultures reflect shared values, beliefs, attitudes and behaviors is disputed by many (Williams, et al). They argue that not all corporate members respond in the same way in any given situation, although they may adopt similar styles of dress, modes of conduct and perceptions of how the corporate body does (or should) function. As such, a cultural theme may be dominant (e.g., quality, safety), but the way in which this theme manifests itself or is expressed will vary; in turn, these may either be aligned or in conflict with the dominating theme. In other words, corporate culture is heterogeneous, not homogeneous. Beliefs, attitudes and values about the corporate body, its function or purpose can vary from division to division, department to department, workgroup to workgroup, individual to individual. Therefore, different subcultures will emerge from or form around functional groups, hierarchical levels and corporate roles, with few values, beliefs, attitudes or behaviors being commonly shared by the whole of the corporate membership. On the basis of such evidence, an industry-wide homogeneous safety culture—let alone a global one—will likely never arise.

The Concept of Safety Culture

The term "safety culture" first appeared in the 1987 OECD Nuclear Agency report on the 1986 Chernobyl disaster (INSAG). Gaining international currency over the last decade, it is loosely used to describe the corporate atmosphere or culture in which safety is understood to be, and is accepted as, the top priority (Cullen). Unless safety is the dominant characteristic of corporate culture—which arguably it should be in high-risk industries—safety culture is a subcomponent of corporate culture, which alludes to individual, job and organizational features that affect and influence safety and health. As such, the dominant corporate culture and the prevailing context—such as downsizing and organizational restructuring (Pierce 36+)—will influence its development and vice-versa, as both interrelate and reinforce each other (Williams). That is, safety

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culture does not operate in a vacuum; it affects and, in turn, is affected by other operational processes or organizational systems.

These other influences become more apparent when theoretical models of accident causation are examined. (See Cooper(f) for a detailed overview.) The most influential of these is Heinrich's domino model, originally conceived in 1931 (Heinrich, et al), and subsequently adapted by Weaver, Adams and Reason. While Heinrich concluded that the key domino was unsafe acts, Weaver (22+) focused on symptoms of operational error (management omissions) that interact with unsafe acts and/or conditions. Adams (27+) emphasized that operational errors were caused by the management structure and its objectives; the synchronization of the workflow system; and how operations were planned and executed. In turn, these operational errors caused "tactical errors" (unsafe acts or conditions). Reason aligned the domino model to a parallel five-element production model and identified how and where safety-related pathogens (e.g., latent and active failures) might be introduced into organizational systems (Figure 1). It is suggested that latent failures are caused by organizational or managerial factors (e.g., top-level decision making), while active failures are triggered by individuals (e.g., psychological or behavioral precursors). Like Adams, Reason shifts the main focus of accident prevention away from unsafe acts and onto the organization's management systems.

Definitions of Safety Culture

The literature contains many definitions of safety culture. For example, Turner, et al defined it as "the set of beliefs, norms, attitudes, roles, and social and technical practices that are concerned with minimizing the exposure of employees, managers, customers and members of the public to conditions considered dangerous or injurious." The International Atomic Energy Authority (IAEA) calls it "that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance." The Confederation of British Industry defined it as "the ideas and beliefs that all members of the organization share about risk, accidents and ill health" (CBI). The Advisory Committee for Safety in Nuclear Installations (subsequently adopted by the U.K. Health and Safety Commission—HSC—in 1993) defined it as "the product of individual and group values, attitudes, competencies and patterns of behavior that determine the commitment to and the style and proficiency of an organization's safety and health programs. Organizations with a positive safety culture are characterized by communications founded on mutual trust, shared perceptions of the importance of safety and confidence in the efficacy of preventive measures."

Similar in concept to corporate culture, each definition speaks to the way people think and/or behave in relation to safety. With the exception of the HSC, they suggest that safety culture "is," rather than something that the organization "has." In the former, safety culture is viewed as an emergent property (set of values, beliefs and attitudes) of social groupings, reflecting an "interpretative view" favored by academics and social scientists. The latter reflects the functionalist view that culture has a predetermined function (implementing controls and policies to improve safety) favored by managers and practitioners. HSC's definition combines both views. The "product of values, attitudes, competencies patterns of behavior" element of the definition reflects an interpretative view, while the functionalist view is reflected by its stated purpose—it determines people's commitment to safety, and the style and proficiency of safety programs.

The lack of clarity about the "product" has caused much of the confusion that currently surrounds safety culture. What exactly is the product? One conceptualization consistent with 1) the assessment characteristics (direction and intensity) of culture (Schein 109+); 2) culture belonging to a group of people (Rousseau); 3) culture as "the way we do things around here" (Deal and Kennedy); and 4) goal-setting theory (Locke and Latham) is "that observable degree of effort by which all organizational members direct their attention and actions toward improving safety on a daily basis" (Cooper(e)).

This definition for the safety culture "product" provides an outcome measure (consequence) that has been severely lacking. Although one could argue that accident rates provide a better outcome measure, these can be inaccurate for various reasons (e.g., underreporting). Even if genuine zero accident rates were achieved, this outcome measure would suffer from a lack of ongoing evaluative data, making it difficult to determine the quality of an ongoing "safety culture." Thus, reductions in accident and injury rates, although important, are not sufficient in themselves to indicate the presence or quality of a safety culture, whereas "that observable degree of effort" is something that can be continuously measured, monitored and assessed.

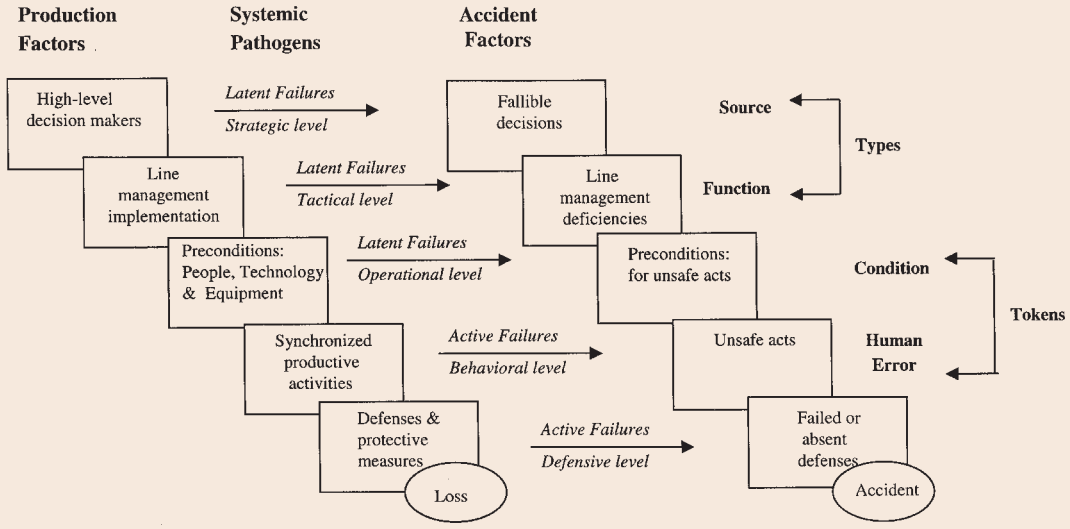
Operationalizing Safety Culture

In practice, developing a safety culture is dependent on the deliberate manipulation of various organizational characteristics thought to affect safety (e.g., conducting risk assessments). The very act of doing so means that such manipulations must be goal-directed. Examining the specific purposes of safety culture reinforces this view. These purposes include 1) reductions in accidents and injuries (Turner, et al); 2) ensuring that safety issues receive appropriate attention (IAEA); 3) ensuring that organizational members share the same ideas and beliefs about risks, accidents and ill health (CBI); 4) increasing people's commitment to safety; and 5) determining the style and proficiency of a safety program (HSC). Each purpose can be viewed both as a subgoal (antecedent) that helps an organization attain its superordinate goal (creating a safety culture) and goal achievement (consequence) that arises from the creation of safety culture. Developing a safety culture, therefore, simply becomes a superordinate goal—one achieved by dividing the task into a series

Safety culture is a subcomponent of corporate culture, which alludes to individual, job and organizational features that affect and influence safety.

Figure 1

Adaptation of Reason Pathogen Model



Setting the difficult goal of developing a safety culture will challenge the entire organization.

of subgoals (e.g., conducting risk assessments, auditing safety management systems, providing safety training) that direct people's attention and actions toward the management of safety.

In goal-theoretic terms, performance is a positive function of goal difficulty. The greater the challenge, the better people's performance tends to be (assuming the challenge is accepted). Setting the difficult superordinate goal of developing a safety culture will challenge individuals, workgroups, departments and an organization as a whole. Dividing the task into more manageable subgoals that are, in themselves, challenging and difficult should lead to much greater overall attainment of the superordinate goal (Cooper(b); Locke and Latham).

Goal attainment is affected by several mediators and moderators, each of which readily translates into safety characteristics. For example, goal-related mediators include the direction of attention, effort and persistence (e.g., people's actual safety-related behaviors at the strategic, tactical and operational levels); task-specific strategies (i.e., the processes of goal achievement); and self-efficacy (people's confidence in pursuing particular courses of action). Goal-related moderators include ability (safety- and job-related competencies); goal commitment (commitment to safety at various hierarchical levels); goal-conflict (e.g., safety vs. productivity); feedback (e.g., safety communications); task complexity (e.g., managerial vs. operative role functions); and situational constraints (such as lack of resources). These moderators and mediators should be examined individually and in various combinations to assess their effect on both the achievement of subgoals and the superordinate goal of creating a safety culture.

Quantifying Safety Culture

No universally accepted model has yet been established to enable the profession to quantify and analyze safety culture. What is required is a conceptual model that facilitates the development of necessary measurement tools. Here, a psychological model is available that reflects a wide range of safety-related evidence. To greater or lesser degrees, this body of evidence reveals the presence of a dynamic reciprocal relationship between psychological, behavioral and situational factors. For example, it is recognized in 1) safety culture definitions; 2) accident causation theories (such as Adams); 3) work conducted to identify the organizational characteristics of high- vs. low-accident plants, which emphasized the interaction between organizational systems, modes of organizational behavior and people's psychological attributes (Cohen 168+); and 4) research examining why cultural change initiatives such as total quality management have failed (Cooper and Phillips(b)).

Consequently, rather than being solely concerned with shared perceptions, meanings, values and beliefs (as many propose), it can be cogently argued that corporate (safety) culture is "the product of multiple goal-directed interactions between people (psychological), jobs (behavioral) and the organization (situational)" (Cooper and Phillips(a)). Viewed from this perspective, the prevailing corporate culture is reflected in the dynamic reciprocal relationships between members' perceptions about, and attitudes toward, the operationalization of organizational goals; members' day-to-day goal-directed behavior; and the presence and quality of systems and subsystems to support goal-directed behavior.

In essence, this definition reflects Bandura's model of reciprocal determinism derived from Social Cognitive Theory (SCT). SCT focuses on cognitively based antecedents (such as goals), behaviors and consequences (such as self-evaluative rewards), while also stressing the use of observable variables for assessment purposes. These same principles are highly valid for safety (Cameron 26+), particularly in the domain of managerial decision making, one of the key routes by which "pathogens" or "latent failures" are introduced into organizations (Reason). This vast body of evidence also suggests that change initiatives which do not consider the reciprocal relationship between psychological, behavioral and situational factors when developing a safety culture are doomed to failure.

Figure 2

Bandura's Model of Reciprocal Determinism

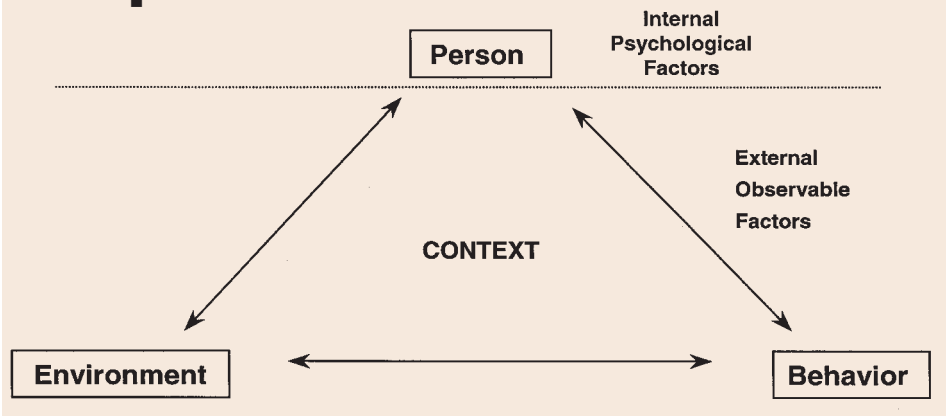
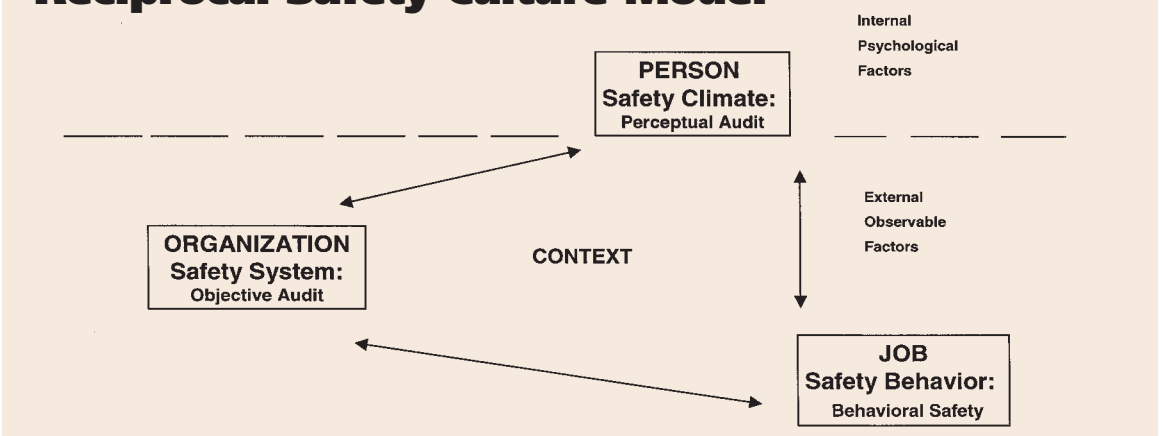


Figure 3

Reciprocal Safety Culture Model



Analyzing Safety Culture

Bandura's model has been adapted to reflect the concept of safety culture (Figure 3). In this new model, each element is measured via commonly used methods. For example, internal psychological factors (attitudes and perceptions) are assessed via safety climate surveys; ongoing safety-related behavior is assessed via behavioral safety initiatives; situational features are assessed via safety management system audits.

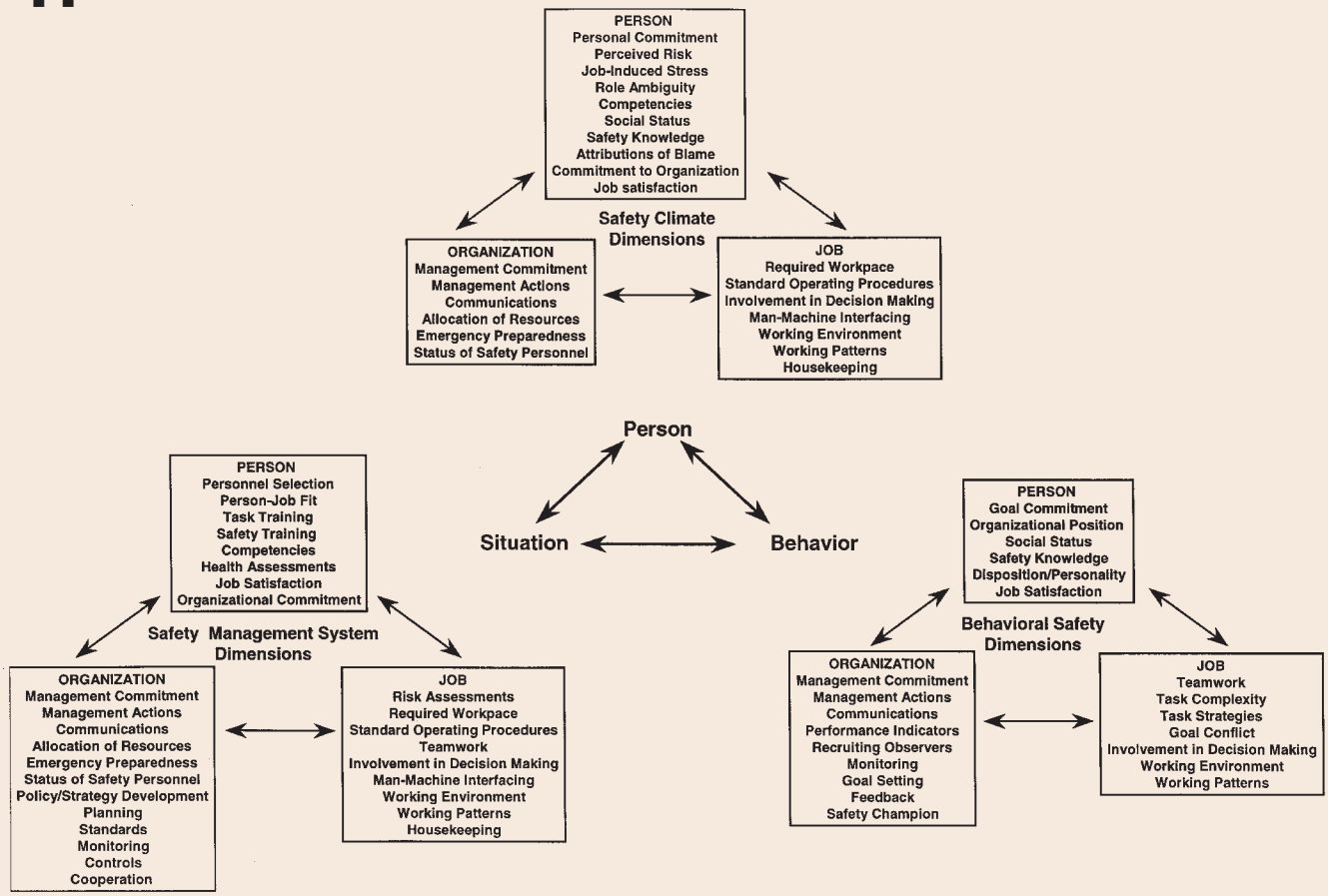
Each element in the model can also be broken down into exactly the same reciprocal relationships (Figure 4); this allows the multifaceted nature of the safety culture construct to be systematically examined, both within and between the three measurement methods. It is recognized that the content of each element as presented may/may not be fully inclusive in relation to safety culture. However, the characteristics labeled were derived from diverse sources such as human factors in industrial safety (HSE); successful health and safety management (HSE); goal-setting theory; behavioral safety research; safety climate research; accident causation models; and studies of organizational characteristics at high- and low-accident plants. Thus, the model provides 1) an integrative way of thinking about the many processes that impact on safety culture; 2) a set of measurement instruments that do not depend solely on incident or accident indices; and 3) a dynamic framework that provides the means with which to conduct multilevel analyses of the safety culture construct in order to identify where cause-effect relationships exist.

Empirical efforts to examine these reciprocal relationships clearly support the model. For example, a study conducted in a U.K. packaging manufacturer (Cooper, et al 219+) showed the impact of situational features (both societal and organizational) on employees' ongoing safety behavior, while a change initiative improved not only such behaviors, but also employees' perceptions of the safety climate. Duff, et al (67+) showed the effect of different approaches to goal setting (situational) on safety behavior in the U.K. construction industry; they reported that participative rather than assigned goal setting produced better results. Similarly, Hurst, et al (161+) audited the safety climate of six hazard sites in four European countries and their process safety management systems. Results indicated that the two measures correlated with each other, but differentially with accident and loss-control rates, demonstrating the practical utility of using a combination of measurement methods.

Although these studies used a between-methods approach, examinations conducted from a within-method approach also offer support. A multiple

Figure 4

Reciprocal Model of Safety Culture Applied to Each Element



regression analysis of 10 separate distributions of a safety climate questionnaire to U.K. chemicals, manufacturing and food industries revealed considerable differences between process workers' and managers' perceptions of risk (Cooper(d)). These findings indicate the extent of each group's frame of reference when assessing risk, while also suggesting that risk perception appears to be culturally determined. As such, it provides strong evidence to support the notion that all levels of personnel must be involved in conducting risk assessments. Similarly, utilizing applied behavioral analyses (within a behavioral safety initiative to examine an organization's accident records) reveals employees' internal motivators (psychological) and the associated pathogens or latent safety management system failures (situational) that affect ongoing safety behavior (Cooper(c)).

Quantification Strategy

Since each safety culture component can be directly measured, or in combination, one can quantify safety culture in a meaningful way at many different organizational levels, which has historically been a challenge. Quantification may also provide a common frame of reference for the development of safety benchmarking partnerships with other business units or organizations—something of particular importance to industries that use specialized subcontractors.

To quantify safety culture, two relatively simple things must occur. The first requires the measurement of "matched" factors within each element of the model. This is best illustrated by using the measurement of management's commitment as an example. Questions would be asked about it via a safety climate survey (e.g., are managers perceived by the workforce as committed?) and also via a safety management system audit (e.g., what is the safety budget relative to the total budget?). The degree to which managers visibly demonstrate their commitment would also be monitored during a behavioral safety initiative (e.g., the frequency with which management "walked the talk").

The second is to use a common metric across each of the three elements. Percentages are perhaps the easiest to use as they are commonly found in safety management system audits and behavioral safety initiatives. Safety climate surveys scores can easily be converted to percentages as well. Percentage scores also facilitate the use of a five-point banding scale that ranges from alarming (0 to 20 percent) to excellent (80 to 100 percent). In principle, the percentage score for each element is calculated and converted into the five-point scale. Scores are then placed on their appropriate axis (Figure 5). Scores relative to each other indicate which of the three safety culture elements is weaker; this area then becomes the focus of attention and corrective action.

Illustration

A safety director for a large multinational company worked with a safety psychologist to develop a

safety climate survey and safety management audit that possessed 100 percent point-to-point correspondence between safety system items to be audited and survey questions. Both instruments reflected activities gleaned from a behavioral analysis that had been conducted two years prior, when the firm's locations implemented a behavioral safety system; this system involved the measurement of various safety-related behaviors of all personnel.

Both instruments were used at the same time. Once complete, the safety director and his team calculated the global safety climate survey score for the whole company via statistical analysis of all responses. The team then calculated a percentage score for the audit by dividing the total number of positive responses to questions by the total number of questions asked; the team also calculated the percentage safe score for the whole company via tracking software. This score was then converted into the five-point banding scale by dividing the percentage score (60.2) by 100 and multiplying the result (=0.602) by 500 (=301). The product was then multiplied by 100 (=3.01). Conversely, the safety climate score (3.10) was converted into a percentage score by multiplying the score by 100 (=310) and dividing the result by 500 (=0.62). The product of this calculation was multiplied by 100 (=62 percent). The final scores were placed on the five-point scale radar graph (Figure 5).

The global safety culture profile indicated that the effectiveness of the systems, people's levels of safety behavior, and their values and beliefs about safety were good, but that each category could be improved. The team examined these categories at the five organization levels within Reason's pathogen model. As Figure 6 shows, this revealed that many of the company's safety efforts were having the greatest effect at the behavioral and defensive levels—that potential active failures were being controlled. In other words, relatively good safety systems were in place and working at the "coalface," with people largely adhering to the rules and procedures and holding reasonably positive attitudes about safety. To a large extent, this result validated the safety work being performed.

Figure 5

Safety Culture Profile

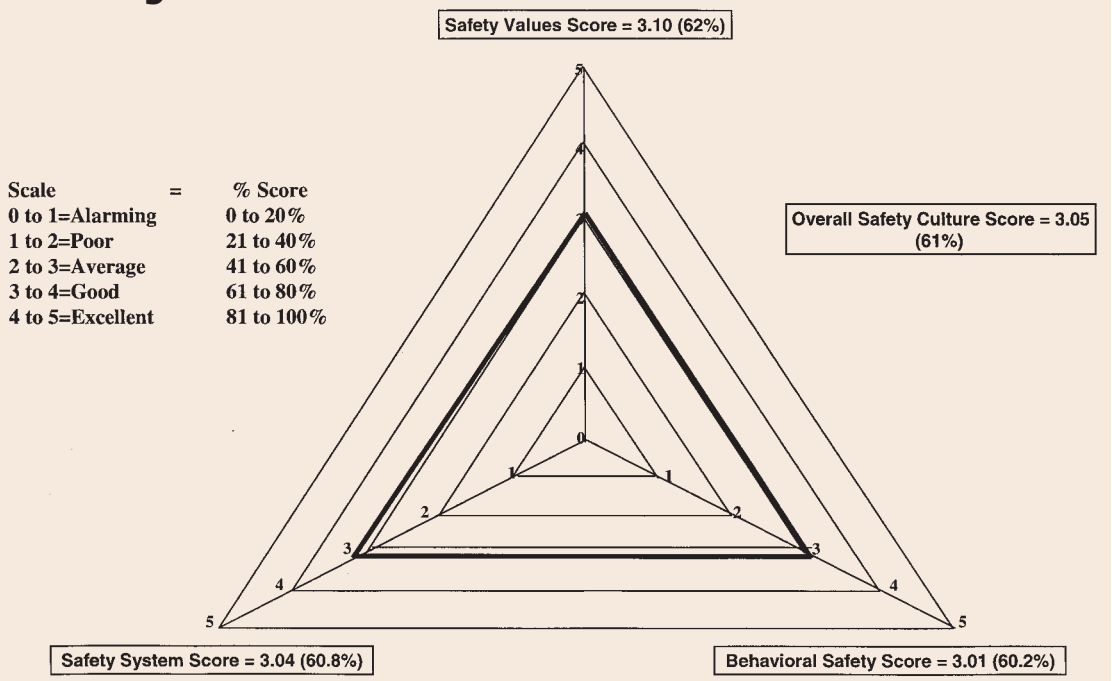


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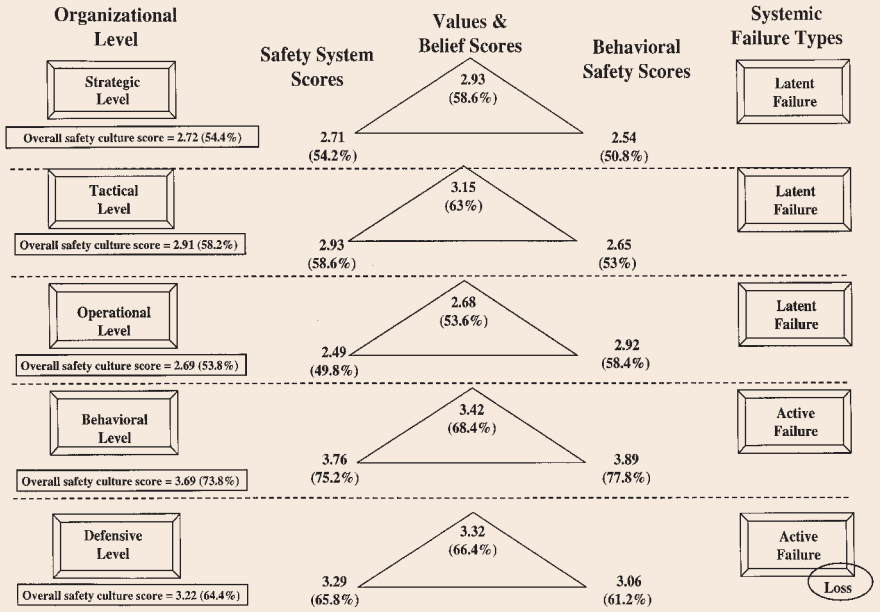
Figure 6

Safety Culture Profile Applied to Reason Pathogen Model



Conversely, the safety effort had been less influential at the strategic (leadership), tactical (managerial) and operational (support) levels. The findings suggested that most accidents were being caused by latent failures developing and laying dormant at each level. In response, the safety director refocused the safety efforts on these three levels in order to identify and eliminate the pathogens so they could not be triggered by active failures at the behavioral level. The team performed similar analyses across the company and was able to usefully benchmark the safety culture profiles of different business units, departments and functional levels; this enabled highly focused corrective actions to be taken. (This example combines hypothetical scenarios and real-world results in order to demonstrate that safety culture can be quantified.)

Conclusion

Adopting a goal-oriented approach to the pursuit of safety culture may help overcome much of the confusion that surrounds the concept. The reciprocal model detailed here offers a common framework with which to guide the development of positive safety culture.

The wide availability of measurement methods means that the profession need not reinvent the wheel or develop new tools. Given Deming's philosophy that "what gets measured gets done," the quantification approach may provide the SH&E profession with the practical means to drive a quantum leap in workplace safety performance. ■

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